DOCUMENT RESUME

ED 389 529 SE 056 855

AUTHOR Schriver, Martha L.; And Others
TITLE A Case Study of a Science and Mathematics Day Camp as Experienced by Seven Girls from Rural Georgia.
PUB DATE Apr 95
NOTE 14p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (San Francisco, CA, April 1995).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Elementary Secondary Education; *Females; *Mathematics Education; Questionnaires; Role Models; Rural Youth; Science Activities; *Science Education; Scientists; *Sex Differences; *Student Attitudes; *Summer Science Programs

ABSTRACT

The focus of this study was a science and mathematics day camp for Girl Scouts in a rural Georgia county, the goal of which was to help girls "discover" themselves as competent participants in science and mathematics. During the camp, Brownie Junior and Cadet Girl Scouts from Bulloch County interacted with women faculty on the campus of Georgia Southern University to learn about science. Seven girls from one Brownie troop participated in the study. Data collection instruments included Draw a Scientist test, questionnaires, and journals. This study provided some insight into the types of experiences the girls had at the science and math day camp. For the short term, the camp made a positive impression on the attitudes of the girls toward science, their feelings of competency, and their images of what a scientist is and does. (JRH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 389 529

A Case Study Of A Science and Mathematics Day Camp as Experienced by Seven Girls from Rural Georgia

PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
M. L. Schriver

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

by

Martha L. Schriver
Assistant Professor
Middle Grades & Secondary Education

Lynn Wolfe
Associate Dean
Health & Professional Studies

and

W. Jay Strickland
Assistant Professor
Sociology & Anthropology

Georgia Southern University
Statesboro, GA 30460

Presented at the Annual Meeting of the National Association for Research in Science Teaching, San Francisco, CA, April 1995

SE 055 655

BEST COPY AVAILABLE

A Case Study Of A Science and Mathematics Day Camp
as Experienced by Seven Girls from Rural Georgia

The focus of this study was a science and mathematics day camp for Girl Scouts in a rural Georgia County. The camp lasted for one week and was attended by scouts of all ages. The goal of the camp was to help girls "discover" themselves as competent participants in science and mathematics. This focus resulted from research concerning the lack of interest and participation of girls in science (Peltz, 1990; Bates, 1994).

A lack of interest in science and negative views of science, become stronger for girls then for boys by the age of eleven. Furthermore, boys show a more positive interest in the physical sciences (Kaplan & Aronson, 1994; Peltz, 1990). Sadker & Sadker (1994) refer to this as a "gender divide" in high school science classes since girls tend to choose advanced biology classes while boys choose chemistry and physics. A similar decline occurs in the achievement of girls according to Bates (1994). He refers to data from the National Center for Education Statistics that shows equal achievement levels for girls and boys in grades three and seven and, although he provides no insight into a cause, he emphasizes that boys have much higher achievement levels than girls by grade eleven.

However, in earlier research by Kahle & Lakes (1983) some insight into these relationships is provided. They suggest that "lack of experiences in science lead to lack of understanding of science and contribute to negative attitudes toward science" (p. 135). Their study indicates that 13 and 17 year old girls are well below the mean in their participation in non-required science activities. These percentages drop even further below the mean when comparing older girls with the younger girls. Another factor beside the girls' lack of experiences and skills that these researchers conclude may affect girls' enrollment and achievement in science is the stereotyped image of science as a male domain.

Early efforts that identified the scientist as a male domain were conducted with high school students (Mead & Metraux, 1957) and later substantiated with elementary students by Chambers (1983). The portrait that prevailed in both studies was one of a male wearing a white

coat, goggles or glasses, and surrounded by laboratory equipment. This perception of careers in science as masculine, along with social and cultural factors, makes science appear relatively useless in girls' daily lives or future careers (Kahle & Lakes, 1983) and produces an image girls want to avoid at any cost (Sadker & Sadker, 1994).

Background

This camp was a collaborative effort between the local American Association of University Women (AAUW), faculty at Georgia Southern University and the Girl Scouts of America in the area. For one week in July, Brownie, Junior and Cadet Girl Scouts from Bulloch County interacted with women faculty on the campus of Georgia Southern University to learn about science. Hands-on sessions were developed by each faculty member relative to her area of expertise and coordinated with topics stressed in the Girl Scout Handbook. This was a new kind of summer camp for these scouts as it focused on science and mathematics activities, rather than the usual outdoor activities and crafts. When troop leaders first told the girls about the theme for the summer camp, the girls' reactions were less than enthusiastic. Several girl scouts were quick to make negative comments about "having to do science" in their day camp and one of the fathers even voiced a concern that his daughter would be trained as a "radical feminist." Comments such as these raised concerns about the eventual success of the camp but at the same time demonstrate a need for this type of activity.

Subjects

The seven girls that participated in this study were all from one Brownie troop and, therefore, all experienced the same activities throughout the camp. All of the girls entered second grade in the fall of 1994. Each girl completed an attitude questionnaire concerning competence and attitudes toward science presented in a likert format. Because of their age, the troop leader assisted with the questionnaire. Each Brownie also drew her image of a scientist. Both of these activities were done before the camp began and then repeated at the conclusion of the camp. In addition, every day the girls spent about 15 minutes writing about their activities in a journal.

Draw a scientist

In each of the girls' drawings you could pick out some influence of their experience during the camp. In some cases the girls' images of a scientist changed from male to female. Although the gender remained the same in the drawings of others, more details and activity were added to the surroundings or the figure.

Gender

One theme of interest was the gender of the scientists in both the pre and post Draw A Scientist Test (DAST). Of interest was whether the stereotypical image of a scientist described by Chambers (1983) and Mead & Metraux (1957) would be prevalent for girls of this age and whether this would change if they interacted with female scientist.

Even the short period of time the girls were involved with the camp and with women faculty appears to have made a difference in Amy and Karen's images of a scientist. At least in the short term, these two girls have changed their view point from the stereotypical image previously mentioned to one of a female scientist still within the laboratory setting. Amy lacked some of the detail in her drawings that the other girls had. However, her initial drawing was of a male scientist complete with bow tie and mustache. At the end of the camp, her image of a scientist was now that female scientist as characterized by the pony tail, a hair style similar to that of the chemistry professor they worked with during the camp. Karen's first drawing is very detailed. Here is the typical mad scientist with his arms thrown in the air saying "it's alive" and the implication that a Frankenstein type monster is on the table. The window to one side of the drawing showing a cloud and lightning adds to the typical scene from a horror film. Karen's second drawing changes drastically. Now her scientist is a girl with long hair, a hat, wearing shorts and a top; very typical of girls at the camp and could be a Brownie or Girl Scout in uniform.

Melinda and Betty's first drawings of scientists were both males. Melinda kept her male scientist in her second drawing but added more detail (see setting). Although Betty's original

drawing is distinctly male, it was hard to identify whether the figure in the second drawing was male or female.

Mary's and Sue's images of a scientist began and remained that of a female with almost no change in appearance from the first drawing to the second. Ann's picture was unusual in that her drawing had a male scientist and a female figure in both of her drawings. The female in the first drawing was much smaller than the scientist, while in the second drawing the female took greater prominence, as described in the following section.

Setting

Beside the representation of a scientist by gender another theme that reflected the girls' impressions of what a scientist does was the amount and types of detail included in the setting of the drawings. Indicative of this theme was the addition of glasses and/or equipment to their second drawings. Many items included in these drawings can be related to the experiences that the girls had on campus. The glasses, for instance, were items of safety that were stressed when the girls were working in the chemistry lab making slime, cleaning pennies or watching the liquid nitrogen demonstration. The equipment is similar to the type found in most chemistry labs, including the one they used during camp. It is interesting that all of the settings are the lab even though the girls were involved in several outside activities with scientists.

In Ann's first drawing, the male scientist was the her prominent figure. Her scientist had two stereotypical characteristics. First, it was a male with balding with hair sticking straight out at the sides, and second he had a pocket with pens or pencils. Ann's drawing also includes a smaller figure of a girl right beside the scientist. The second drawing contains the same two figures but includes a similar girl, who is now larger in size and with glasses. Betty's first scientist is the only thing in her drawing while her second scientist has now been placed in a laboratory with equipment and smoking gas coming from one container.

Sue also added glasses to the girl in her drawings. She even included the strap extending from the glasses around the girl's head. In her two drawings, the girl is standing beside a table with what looks like water or gas outlets on it, smiling. Mary's first drawing showed just a girl

with long hair, long lashes and a neutral facial expression. The second drawing has a stick figure wearing glasses and smiling and now holding a container in her hand. Melinda's first drawing showed only the head of a scientist with short hair sticking straight up, big ears, glasses and a table with equipment on it. The caption simply says "A frog." Her second drawing has a complete figure of what appears to be the same head but now beside a table with equipment that is smoking and the caption this time is "P-U". The top of the drawing has something hanging down, possibly lights.

Passive/Active

The theme of wearing glasses to protect your eyes also fits with the perspective of an active scientist, one who is doing something, rather than being passive, just standing alone. This is confirmed in many cases by the equipment shown as giving off smoke or possibly some type of gas. Betty's drawing is a good example of this. She no longer draws the solitary figure of her first drawing. Her scientist is now in a laboratory with equipment and smoking gas coming from one container.

Smoke or gas coming from the top of one of the containers is prominent in Melinda's second drawing and is another reoccurring theme in many of the drawings. This is probably related to the liquid nitrogen demonstration the girls observed while in the lab. In Mary's drawing this connection is obvious since written to the side [with the assistance of the troop leader] are the words "pouring liquid nitrogen on the floor." Melinda's two drawing both contained captions for the figure. Her first drawing showed only the head of a scientist, and other than a caption with the words "A frog", her scientist appears separate from the equipment. Her second drawing with the complete figure shows the scientist's hands up in the air standing beside a table with equipment and again the "smoking" container and the caption this time is "P-U". Again the scientist has gone from passive to actively doing something in the lab. As mentioned previously, Ann's drawings were unusual in that they both included two people. Her second scientist is now talking ("my lab") and her young girl, no longer smaller than the scientist or standing beside him, but has now moved close to the table with the equipment.

Questionnaire

The questionnaire, adapted from Fennama & Sherman contained ten questions (Figure 1), five concerning science attitude (whether they liked science) and five pertaining to whether they felt competent in science. All but one of the girls showed positive changes in their competency toward science. In addition, five of the girls showed positive changes in attitude; one had a slightly negative change.

Attitude toward Science

All but one of the girls' score concerning attitude toward science changed from the pre to the post test. Melinda, who's attitude score did not change, started with the highest responses possible on the attitude questions (except for one question) and her responses remained at this high level at the end of camp. Karen had a drop in her total score from strongly agree or disagree, on two questions, to agree/disagree.

The question that resulted in the most positive change in attitude was "I don't understand how people can enjoy spending a lot of time on science." Amy, Betty and Mary had responses that were similar to those reported by Kahle & Lakes (1983). Their research indicated girls were significantly below the mean when it came to choosing to do science activities. In this situation it is not a question of whether they would choose to spend time on science but rather whether they could understand others choosing to spend time on science. Initially these three girls indicated that they could not understand this occurrence. By the end of the camp, all of these girls strongly disagreed with the statement, that is they could understand why people would spend a lot of time on science. For Betty and Mary this was indicative of an overall change in attitude. These two girls, who had the lowest attitude scores at the beginning of the camp had the highest attitude scores at the end of camp. For Mary this was despite a less than perfect week at the camp according to her journal. She expressed negative feelings because she was sick (She was taken to the nurse because of the heat, the second day of the camp) and the fact that it rained (We had a major thunderstorm canceling one afternoon activity the next to last day of the camp.).

Another question that received the most consistently positive change in attitude concerned problem solving in science ("Figuring out science problem does not interest me.") Melinda and Karen's responses were initially at the highest level for this question. The responses of the other five girls increased positively for this question by the end of camp. Amy, Sue and Ann's responses changed from disagree to strongly disagree. While Betty was undecided in her response the first time, Mary agreed that this was not of interest to her. By the end of camp both girls responded that they strongly disagreed with this statement.

Only Karen had pre to post scores on the attitude questionnaire that went down. On two questions, one concerning liking science project and the other on the amount of work she does in science, her responses dropped by one, although they were still on the positive side. Her journal was not helpful in providing insight into this decline as her comments concerning the science activities were either positive or non-committal. Her journal seemed to indicate that she did get actively involved with the activities ; she mentioned working with snails and even named her snails.

Feelings of Competence in Science

All of the girls except Ann felt more competent about science at the close of the camp. Ann felt less competent concerning two statements: "Science is hard." and "I think I can do well in science." In each case, her initial response was at the highest end of the likert scale and dropped one ranking. All of the other girls increased their feelings of competence by a range of two to seven rankings on their total scores.

Feelings of competence were more positive most consistently for the question: "Science is hard for me." This question also showed the largest gains in feelings of competence. In addition, four of the seven girls responded that were more sure of themselves in science by the end of the camp. Mary and Melinda had the strongest positive feelings in response to these two questions, but Karen showed more positive responses over all of the questions.

Journals

The girls expressed feelings with contained a wide range of expressions, from happy to sad; one girl even added a happy or sad face to her comments. Most of the positive comments were made concerning specific activities they liked and participated in or people they liked working with in the camp. Many of the statements were very direct referring specifically to liking something or having fun doing a particular activity. For instance, Melinda said, "I liked the pigeons" while Betty stated, "We haved Fun Playing with the sals [snails]."

Other girls seemed to generalize their feelings and then listed their activities. Sue's comments are a good example: " Today was a great day (ecsept for I didn't feel good.) Maybe the best yet. First we did a servae, We counted our teeth, We saw how many bubbles we could blow in 30 seconds and how many time we could hop on our left foot in a row and a cherio tasting contest and we went to the Starlab we made slime and we drew with magical ink." Other students listed one or two specific activities and then made more general comments about the day. For example Amy wrote, " I like brownie camp it's fun. We made paper. We did math and science We had a snack befor Lunch. We talked bout snails "

Although negative feelings were also expressed in the journals, these were focused on the logistics of the camp; walking from one place to another, being sick, and the weather . The comments in these three areas were usually quite direct. One of Betty's comment illustrate this: "We got sokeing Wat! I det like it." One other topic of comment which was more a statement which implied dissatisfaction, was made by Ann: " The bathrooms were smelly." Even Karen, the only student to show a drop in attitude scores mixed the negative comments in her journal with positive remarks.

Karen: "We mayed slime Today was fun We walked and Walked and Walked.

That was not fun. But we got to sing. We got to have fun I had a good day"

And then later in her journal: "I did't,, like to walk. I had fun in girl scouts. We saw a dog. We liked the dog."

It was of interest that some activities were not mentioned in the journals either negatively or positively. The excluded activities could be thought of as not being very memorable. However, for some students, the timing of the activity should also be considered. If the activity was done early in the day it might not have been recalled with as much frequency as an activity that occurred immediately before they wrote in their journals.

Conclusions

The results of this type camp as one means of addressing the concern for involving more women in the fields of science and engineering (Rutherford & Ahlgren, 1990) are promising. This study of seven Brownie Scouts provided some insight into the types of experiences the girls had at the science and math day camp. For the short term; according to the journals, questionnaires, and the Draw A Scientist Test, the camp made a positive impression on the attitudes of the girls toward science, their feelings of competency and their images of what a scientist is and does. Even though negative feelings were expressed concerning the camp, none of these referred to the science activities, instead facilities and lack of transportation were their major concerns.

The Draw A Scientist Test indicated that, at least for this age girl, the view of a scientist as male was the prevalent image but not the exclusive image. That two of the seven girls (28%) started with the image of a scientist as female is encouraging considering past research. It also appears that the stereotypical image of a scientist (Chambers, 1983) can be changed with relative success at this age. Even the short term exposure to women role models that this camp offered had a positive effect for two out of five girls. In addition, when considering the greater detail that was included in most of these drawings, it seemed to provide the girls with a clearer image of how and where some scientists work. However, this experience did not alter the perception that a scientist works only in a lab. Even though the girls were exposed to several activities that were conducted in other types of settings, this view of a scientist in a laboratory still remains.

In both their journals and through their responses to the questionnaire, the girls indicated positive attitudes toward science. As is expected for this age group, they like to be actively

involved even to the point of mentioning specific things they did. For example, Amy even indicated a feeling of participation in the demonstration with liquid nitrogen with her comments "We froze a [rubber] band, green pepper, and green stuff."

The use of informal types of experiences, an area in which many girls are lacking(Kahle & Lakes, 1983), appeared to have a positive effect on both attitudes and feelings of competence of these seven girls. Camps of this type, particularly for girls of this age, seem to have at least a short term effect on how they see scientists and themselves doing science.

References

Bates, P. (1994) Say yes to science. Equality Coalition, III (2), 1&29.

Chambers, D. W. (1983). Stereotypical images of the scientist: The draw-a-scientist test. Science Education, 67 (2): 255-265.

Kaplan, J. & Aronson, D, (1994). The numbers gap. Teaching Tolerance, Spring, 21-27.

Kahle, J. B. & Lakes, M. K. (1983).The myth of equality in science classrooms. Journal of Research in Science Teaching, 20, (2) 131-140.

Mead, M. & Metraux, R. (1957). Image of the scientist among high school students. Science, 126: 384-390.

Peltz, W. H. (1990) Can girls + science - stereotypes = success? The Science Teacher, Dec., 44-49.

Rutherford, E. J. & Ahlgren, A. (1990). Science for all Americans. New York: Oxford University Press

Sadker, M. & Sadker, D. (1994). Failing at fairness: How America's schools cheat girls. New York: Schribners

Figure 1

Change in Responses

	Attitude						Competency				
name	#2	#4	#8	#12	#24		#6	#14	#17	#20	#22
Amy	+3	+1	0	0	0		+2	+1	0	0	0
Ann	-1	+1	0	0	+1		0	-1	-1	0	0
Betty	+3	+2	+2	+3	+1		+1	0	+2	+1	+1
Karen	0	0	-1	-1	0		0	+2	+1	+1	+2
Mary	+3	+3	+4	+2	+1		0	+3	0	+2	+2
Melinda	0	0	0	0	0		0	+3	0	+2	0
Sue	0	+1	-1	0	0		+1	+1	0	0	0

#2. I don't understand how people can enjoy spending a lot of time on science.

#4. Figuring out science problems does not interest me.

#6 I think I could handle more difficult science problems.

#8. I like science projects.

#12. I do a little work in science as possible.

#14. Science is hard for me.

#17. I think I can do well in science

#20. I am sure of myself in science.

#22. Science has been my worst subject

#24. Science is fun and exciting